AUTHOR INDEX

Amstutz, H.C., 123
Arciero, R.A., 194

Bardana, D.D., 183
Bargar, W.L., 153
Bauer, A., 9
Beaulé, P.E., 123
Berger, R.A., 138
Berlemann, U., 14, 69
Blackwell, M., 82
Bottoni, C.R., 194
Bourquin, Y., 40, 69
Burks, R.T., 183

Cassinelli, E.H., 254
Catino, M.A., 301
Colgan, B.D., 3
Crutcher Jr., J.P., 102

Debski, R.E., 87
DiGioia III, A.M., 1, 3, 82
Dirksmeier, P., 120, 282
Doehring, T.C., 246

Foley, K.T., 64, 77
Frölich, J.J., 50
Fu, F.H., 87, 162
Fujisawa, Y., 212
Fults-Ganey, K.A., 169

Ganz, R., 14
Gard, P.J., 94
Gilbertson, L.G., 246
Goble, M., 220
Gotzen, L., 50

Hall, R.A., 263
Healey, W.L., 94
Heeckt, P.F., 50
Heinze, R., 50
Hozack, W.J., 133

Iorio, R., 94
Ishimura, M., 212

Jaramaz, B., 1, 3, 82
Johnson, D.L., 209
Jordan, M.R., 234

Kahler, D.M., 20
Kanade, T., 82
Kang, J.D., 245, 246, 254, 263, 282
Kässermann, S., 40
Kim, C.W., 227
Kober, R., 50
Kunz, M., 40

LaBarca, R.S., 3
Langlotz, F., 14
Lavallee, S., 56
Lee, J.M., 162
Leopold, S.S., 138
Lewis, S.J., 288

Macaulay, W., 106, 115
McAfee, P.C., 301
McCulloch, J.A., 288
Merloz, P., 56
Miles, R.P., 146, 161, 209
Moody, J.E., 3
Newman, M.A., 153

Nikou, C., 3, 82
Nolte, L.-P., 14, 40, 69

Parks, M.L., 106, 115
Patel, A., 311
Pedowitz, R.A., 227
Petermann, J., 50
Piasecki, A.W., 138
Picard, F., 25
Pittet, L., 56

Rampersaud, Y.R., 64, 77
Riew, K.D., 288
Rothman, R.H., 133

Saal, J.A., 271
Saal, J.S., 271
Saluja, R., 153
Sanders, T.G., 169
Saragaglia, D., 25
Sati, M., 40, 69
Scaduto, A.A., 325
Schwender, J.D., 320
Sharkey, P.F., 133
Shilling, J.W., 133
Simon, D.A., 77
Sinha, R.K., 93, 120, 146
Stäubli, H.U., 40
Stulberg, S.D., 25

Tonetti, J., 56
Tontz, W., 227

Vangura, A.J., 87
Vogrin, T.M,, 87

Wang, J.C., 325
Welch, W.C., 311
Wiedel, J.D., 153
Withrow, J.D., 87
Wong, E.K., 87
Woo, S.L-Y., 87
Wood, K.B., 320

AUTHOR INDEX

Amstutz, H.C., 123
Arciero, R.A., 194

Bardana, D.D., 183
Bargar, W.L., 153
Bauer, A., 9
Beaulé, P.E., 123
Berger, R.A., 138
Berlemann, U., 14, 69
Blackwell, M., 82
Bottoni, C.R., 194
Bourquin, Y., 40, 69
Burks, R.T., 183

Cassinelli, E.H., 254
Catino, M.A., 301
Colgan, B.D., 3
Crutcher Jr., J.P., 102

Debski, R.E., 87
DiGioia III, A.M., 1, 3, 82
Dirksmeier, P., 120, 282
Doehring, T.C., 246

Foley, K.T., 64, 77
Frölich, J.J., 50
Fu, F.H., 87, 162
Fujisawa, Y., 212
Fults-Ganey, K.A., 169

Ganz, R., 14
Gard, P.J., 94
Gilbertson, L.G., 246
Goble, M., 220
Gotzen, L., 50

Hall, R.A., 263
Healey, W.L., 94
Heeckt, P.F., 50
Heinze, R., 50
Hozack, W.J., 133

Iorio, R., 94
Ishimura, M., 212

Jaramaz, B., 1, 3, 82
Johnson, D.L., 209
Jordan, M.R., 234

Kahler, D.M., 20
Kanade, T., 82
Kang, J.D., 245, 246, 254, 263, 282
Kässermann, S., 40
Kim, C.W., 227
Kober, R., 50
Kunz, M., 40

LaBarca, R.S., 3
Langlotz, F., 14
Lavallee, S., 56
Lee, J.M., 162
Leopold, S.S., 138
Lewis, S.J., 288

Macaulay, W., 106, 115
McAfee, P.C., 301
McCulloch, J.A., 288
Merloz, P., 56
Miles, R.P., 146, 161, 209
Moody, J.E., 3
Newman, M.A., 153

Nikou, C., 3, 82
Nolte, L.-P., 14, 40, 69

Parks, M.L., 106, 115
Patel, A., 311
Pedowitz, R.A., 227
Petermann, J., 50
Piasecki, A.W., 138
Picard, F., 25
Pittet, L., 56

Rampersaud, Y.R., 64, 77
Riew, K.D., 288
Rothman, R.H., 133

Saal, J.A., 271
Saal, J.S., 271
Saluja, R., 153
Sanders, T.G., 169
Saragaglia, D., 25
Sati, M., 40, 69
Scaduto, A.A., 325
Schwender, J.D., 320
Sharkey, P.F., 133
Shilling, J.W., 133
Simon, D.A., 77
Sinha, R.K., 93, 120, 146
Stäubli, H.U., 40
Stulberg, S.D., 25

Tonetti, J., 56
Tontz, W., 227

Vangura, A.J., 87
Vogrin, T.M,, 87

Wang, J.C., 325
Welch, W.C., 311
Wiedel, J.D., 153
Withrow, J.D., 87
Wong, E.K., 87
Woo, S.L-Y., 87
Wood, K.B., 320

SUBJECT INDEX

Abductor limp, complication, total hip replacement surgery, 112-113
AC joint, see Acromioclavicular joint
Acetabulum
  classification of defects, 149
  combined cavitary and segmental defects, surgical repair, 153-159
  component
    oblong, 154
      use in complex acetabular reconstruction, 153-159
    total hip replacement implants, 99
  cup
    accurate placement during THR surgery using HipNav, 3-8
    impaction using HipNav, 7
    measurement of orientation ussing HipNav, 8
  dysplasia, computer-assisted surgery for, 14-19
  evaluation for revision total hip replacement surgery, 105
  fractures, percutaneous fixation with computer-assisted surgery, 20-24
  grading of cartilage, 124
  hip dysplasia, computer-assisted surgery, 14-19
  long acetabular defect, radiography, 158
  osteolysis, surgical repair, 146-152
  percutaneous fixation of fracture using computer-assisted surgery, 23
  planner, HipNav, 4
  positioning of, and pelvic position in hybrid total hip replacement surgery, 117
  radiographic templating prior to total hip replacment surgery, 103
  reconstruction
    complex, use of oblong acetabular components, 153-159
    morsellized graft, 146-147
    porous-coated cementless revision, 146-147
    preoperative evaluation, 154
    structural bulk allografts, 147
    surgical technique, 155-156
  reinforcement rings, acetabular reconstruction, 148
  revision, 146-152
    strategies for, 148-151
    surgical technique, 149-151
  uncemented in hybrid total hip replacement surgery, 115-118
ACL, see Anterior cruciate ligament
Acromioclavicular joint, biomechanics of normal and injured, robotic UFS system, 89
Adeno-associated virus, vector for gene delivery, 265
Adenovirus
  gene transfer to intervertebral disc, 266-267
  vector for gene delivery, 265
Aging
  alterations with, 256-258
  lumbar intervertebral disc, 255-256
ALIF, see Anterior lumbar interbody fusion
Alignment devices
  for anterior-posterior femoral resection, 32
  for tibial cut in TKR computer-assisted surgery, 33
Allograft, meniscal repair, 220-226
Allografting, impaction, for femoral component revision in total hip replacement, 138-145
Anatomic fiducials, for CAS, 57
Anatomic Medullary Locking prosthesis, hip replacement implant, 98
Anatomy
  knee
    lateral side, 198
    medial side, 197
  lumbar intervertebral disc, 254, 289-290
  lumbar vertebra, 296
  meniscus of knee, 162-163, 170
    posterior views, 235
Anesthesia, for microlumbar discectomy, 290-291
Ankle, determination of rotational center using rotational technique, 30
Annular lamellae, intervertebral disc
  delamination, 271-272
  neovascularization through tears, 272
  tearing, 271-272
Annulus fibrosis, role in lumbar disc herniation, 272
Annulus, intervertebral disc, temperature distribution through, 276
Anterior cruciate ligament
  arthroscopic reconstruction using computer-assisted technology, 40-49
  biomechanics, robotic UFS system, 88
  drilling in computer-assisted ACL reconstruction, 44-45
  elongation analysis in computer-assisted ACL reconstruction, 44
  functional considerations for placement, 40
  impingement avoidance in computer-assisted reconstruction, 43-44
  interoperator variance in computer-assisted reconstruction, 45-46, 48
  positioning during arthroscopic reconstruction using computer-assisted surgery, 43-44
  reconstruction
    biomechanics, robotic UFS system, 88
    computer-assisted planning, 50-55
    conventional surgical techniques, 50-51
    robot-assisted surgery, 50-55
  study with robotic UFS system, 87-88
Anterior lumbar interbody fusion
  complications, 308
  indications, 301-303
  metallic cages, 301-310
  ream long-cage short principle, 305
  surgical results, 305, 308
  surgical technique, 303-305
Anterior pelvic fixator, attachment for acetabular fractures, 21
Anterior transverse ligament, MRI, 174
Approaches, surgical, total hip replacement, 106-114
Arthrex Dart, meniscal repair tool, 209
Arthroplasty, hemiresurfacing, for osteonecrosis of the hip, 123-132
Arthroscopy
  computer-assisted for ACL reconstruction, 40-49
  meniscus
    all-inside repair, 206
    lateral variant, asymptomatic stable, 236
    medial, 203
    outside-in repair, 204
    preparation with Bowen rasp, 200
    repair outcome, 218
    stable lateral variant with tear, 237, 238
    stable lateral variant, torn, 238
    superior surface of, 203
  posterior horn and capsular insertion with tibial recess, 196
  posterior horn of medial meniscus, 205
  posteromedial compartment with meniscosynovial junction tear, 195
  using augmented reality imaging technology, 86

Asepsis, in hybrid total hip replacement surgery, 116-117
Augmented reality imaging technology
  institutions developing, 83-85
  limitations, 86
  for orthopaedic surgery, 82-86

Back pain, in lumbar disc herniation, 272. See also Low back pain
Bagby and Kulich device, 320
  computer-simulated placement for training, 74
  and fusion following surgery, radiograph, 309
  metallic cage for anterior lumbar interbody fusion, 301-310
  position in anterior lumbar interbody fusion, 307-308
  spinal cage, 69
BAK method, see Bagby and Kulich device
Bernese periacetabular osteotomy, computer-assisted, 14-19
Biochemistry, meniscus of knee, 164
Biomechanics
  lumbar spine, study methods, 246-253
  meniscus of knee, 165-166
Bionx Arrow, meniscal repair tool, 209
Bipolar cups, in acetabular reconstruction, 145
Blumensaat line
  alignment for computer-assisted arthroscopic ACL reconstruction, 43
  positioning of tibial point to avoid notch impingement, 54
Brigham and Women's Hospital, and Massachusetts Institute of Technology, development of augmented reality imaging technology, 83
Bursa, inflamed, at knee, 231

Cages, intervertebral, see Bagby and Kulich device; Intervertebral cages; Metal cage; Ray Threaded Fusion Cage; Spinal cage; Titanium
CAOS, see Computer-assisted orthpaedic surgery
Carnegie Mellon University
  and University of Pittsburgh Medical Center Shadyside Hospital, development of augemented reality imaging technology, 85
  image overlay system, 85
Cartilage, acetabular, grading of, 124
CAS tools, see Computer-assisted surgical tools
CASPAR System
  planning and surgery for ACL reconstruction, 51-55
  see also Computer-assisted planning and robotics system
  simulated registration error, ACL reconstruction, 51
Cemented cups, in acetabular reconstruction, 146
Cementless revision, porous-coated, acetabular reconstruction, 147
Cementless stems, double-tapered, for total hip replacement, 120-122
Charnley method, low friction arthroplasty, 106, 115
Charnley scores, modular versus nonmodular femoral components, 136
Charnley-type stem, use in femoral impaction allografting, 138
Chondrocalcinosis, postoperative MRI, 177
Clearscrew, meniscal repair tool, 210
Collagen
  bovine, effect of electrothermal treatment, 274
  effect of electrothermal therapy on, 273-274
  in lumbar intervertebral disc, 255
Collarless Polished Taper stem, use in femoral impaction allografting, 138
Computational models, joints, validation of models from data obtained from robotic UFS system, 90
Computed tomography
  interbody fusion cage placement, 317
  use in evaluating candidates for posterior lumbar interbody fusion, 312-313
  use in preoperative planning for acetabular revision, 148-149
Computed tomography, use in
  CASPAR System for ACL reconstruction, 51-55
  computer-assisted spinal surgery, 56-63
  data in computer-assisted percutaneous fixation of acetabular fractures, 21-23
  HipNav, 3-5
  Robodoc procedure for THR, 9, 10
  scans in computer-assisted PAO, 16
  Stealth Station spinal surgery, 64-68
Computer-assisted planning and robotics, ACL reconstruction, 50-55
Computer-assisted surgery
  anatomic fiducials for, 57
  arthroscopic reconstruction of ACL, 40-49
  definition, 20
  evolution of technology, 62
  material fiducials, 57
  navigation software, 57
  orthopedic system, 70
  percutaneous fixation of
    acetabular fractures, 20-24
    pelvic ring disruptions, 20-24
  periacetabular osteotomy, 14-19
  registration methods, 57
  see also Image-guided surgery
  spinal, 56-63
    spinal cage delivery, 69-76
  surface-based registration, 57
  surgical instrument visualization in, 57
  three-dimensional localizer, 56
  tibial alignment guide in TKR, 29
  total knee replacement arthroplasty, 25-39
Computer-assisted surgical tools, 1
CONSERVE hemiresurfacing femoral component, 129
CT, see Computed tomography
Cutting blocks, positioning during computer-assisted TKR surgery, 34-36
Cyst
  ganglion, at knee, 231
  sebacious, at knee, 231
  meniscal
    algorithm for management, 231
    diagnosis, 227
    etiology, 227
    microscopic structure, 230
    MRI, 179
    pathology, 227-231
    surgical technique for excision, 232
    treatment, 231
Cytokines, role in low back pain, 259, 260

Decompression
  ipsilateral foraminal, 299
  lumbar
    surgical technique, 298-299
    use of microscope in, 298-299
  treatment, lumbar radiculopathy, 288-300
DigiMatch Technology, pinless planning for THR surgery using Robodoc system, 10
Disc, see Intervertebral disc; Lumbar intervertebral disc
Discectomy
  and limited laminotomy, lumbar disc surgery, 286
  microlumbar, treatment, lumbar radiculopathy, 288-300
  see also Microlumbar discectomy

Discogenic pain, treatment with posterior lumbar interbody fusion, 312
Discoid lateral meniscus, 234-244
  unstable, partial excision and stabilization, 241, 242-243
  MRI, 178
Dislocation
  complication
    impaction allografting, 143
    total hip replacement surgery, 112
  hip, after THR surgery, 3
Display device, augmented reality imaging technology, 83
DLM, see Discoid lateral meniscus
DNA-ligand complex, nonviral vector for gene delivery, 265
DRA, see Dynamic reference arc
Drill, determination of position in image-guided spinal surgery, 59, 67
Dynamic reference arc
  surgical reference system for image-guided spinal surgery, 64, 66
  use in virtual fluoroscopy system, 77-78
Dysplasia, acetabular, computer-assisted surgery for, 14-19

Electrothermal therapy
  delivery systems, 275
  effect of collagen on, 273-274
  intervertebral disc
    criteria for including patients, 276-277
    postoperative guidelines, 277
  intradiscal, for chronic discogenic low back pain, 271-281
  mechanisms of action, 276
  technique, 279
  temperature-mapping studies, 274-276
Endoscopic surgery
  computer-enhanced, 70-72
  see also Microendoscopic discectomy
Exeter stem, use in femoral impaction allografting, 138

Facetectomy, in posterior lumbar interbody fusion surgery, 314
Femoral component
  revision, impaction allografting in total hip replacement, 138-145
  rotation
    establishing during computer-assisted TKR surgery, 37
    mechanical versus computer-assisted techniques, 31
  size, mechanical versus computer-assisted techniques, 31-32
Femoral planner, HipNav, 5
Femur
  anterior-posterior resection, mechanical versus computer-assisted techniques, 32
  cemented in hybrid total hip replacement surgery, 115-118
  deficient, repair with femoral revision hip arthroplasty, 133-137
  determining level of femoral neck resection for total hip replacement surgery, 104
  digitization for computer-assisted arthoscopic ACL reconstruction, 42-43
  distal cut, mechanical versus computer-assisted in TKR, 30
  dome, resection for hemiresurfacing arthroplasty, 127
  evaluation for revision total hip replacement surgery, 105
  fracture and perforation, complication, impaction allografting, 143
  head
    collapse in osteonecrosis, 123
    determination of center using rotational techniques, 28
    preparation for hemiresurfacing arthroplasty, 126
    radiographic assessment for hemiresurfacing arthroplasty, 125
  Mallory classification of bone defects, 134
  navigating point of insertion using CASPAR System, 53
  planning tunnel for ACL reconstruction using CASPAR System, 53
  preparation for double-tapered cementless stems, total hip replacement, 120-121
  preparation for TKR computer-assisted surgery, 30-31
  reconstruction algorithm, 139
  revision hip arthroplasty, modular versus nonmodular, 133-137
  sizing of implant for computer-assisted TKR surgery, 37
  templating for total hip replacement surgery, 103-104
Fibrin glue, athroscopic meniscal repair with, 212-219
Fiducial array, attachement for acetabular fractures, 21
Fiducials, C2 vertebra, using Stealth Station System, 66
Flashpoint5000 localizer, use in image-guided spinal surgery, 57
FluoroNav Virtual Fluoroscopy System, 78
Fluoroscopy
  guidance in anterior lumbar interbody fusion surgery, 303
  positioning of dilator in microendoscopic discectomy, 284
  virtual, 77-81
    advantages of system for spinal and musculoskeletal procedures, 80
    requirements for system, 77-78
Fracture reduction, using augmented reality imaging technology, 85-86
FSU, see Functional spinal units
Functional spinal units, lumbar, load-displacement characteristics, 247

GAM, see Gene activated matrix
Gene activated matrix, use in spinal fusion, 329
Gene gun, nonviral vector for gene delivery, 265
Gene therapy
  applications for intervertebral disc degeneration, 263-270
  carriers, 327-328
  ex vivo
    for spinal fusion, 328-329
    versus in vivo, 328
  gene delivery systems, 264-266
  historical perspectives, 263
  in vivo for spinal fusion, 329
  induction of fusion in rat spine, 329
  lumbar fusion surgery, 325-331
  strategies, 326-327
  target cell type, 328
  target tissues for, 266
  vectors, 327
Gene transfer, strategies for, 263-264
GH capsule, see Glenohumeral
Glenohumeral capsule, biomechanics of normal and injured, robotic UFS system, 89

Hardinge approach, total hip replacement, 109
Harris Hip Score, modular versus nonmodular femoral components, 136
Heat, see Electrothermal therapy
Hemiresurfacing arthroplasty
  case illustration, 131
  clinical results, 130-131
  indications for, 124-125
  instruments needed for, 126
  for osteonecrosis of the hip, 123-132
  radiography after, 131
Herniation
  far lateral, intervertebral disc, 296-298
  foraminal disc, treatment, microlumbar discectomy, 288-300
  intervertebral disc, locating during microlumbar discectomy, 294

lumbar disc
MRI, 306
treatment, microlumbar discectomy, 288-300
Herpes simplex virus, vector for gene delivery, 265
Heterotrophic ossification, complication, total hip replacement surgery, 112
Hip
arthroplasty, femoral revision, modular versus nonmodular, 133-137
center
and femoral stem loosening, 147-148
high, acetabular reconstruction, 147-148
joints, dysplastic, computer-assisted surgery for, 14-19
osteonecrosis
hemiresurfacing arthroplasty, 123-132
modified Ficat staging, 124
radiograph of lesions, 130
radiographic evaluation, 124
staging of the disease, 123-124
replacement, hybrid total
operative team needed, 119
patient selection, 115-116
posterolateral approach used, 117
preoperative planning, 116
surgical technique, 117-119
replacement, total
acceptable levels of documented success for implants, 96-97
acetabular reconstruction for failed procedure, 146-152
anterior approach, 106-107
anterolateral approach, 107-109
cementless, 115
comparison of methods, 112-113
complications, 112-113
direct lateral approach, 109
direct lateral approach, 110
double-tapered cementless stems, 120-122
HipNav use for surgical navigation, 3-8
hybrid surgery, 115-119
impaction allografting for femoral component revision, 138-145
implant choice, 94-101
lateral transtrochanteric approach, 109-111
operative approaches, 106-114
optimization of long-term results, 99-100
patient distribution, 95-97
patient factors and implant selection, 94-95
pin-based surgery using Robodoc system, 11-12
pinless surgery using Robodoc system and DigiMatch Technology, 13
posterolateral approach, 111-112
preoperative planning, 102-105
using HipNav, 3-5
preoperative simulation using HipNav, 3-5
radiographic evaluation, 102
ROBODOC system, 1
robot-assisted in primary and revision cases, 9-13
see also Implants, hip replacement
Smith Petersen approach, 106-107
templating principles for revision surgery, 105
transgluteal approach, 109
Watson-Jones, 107-109
see also Acetabular cup; Periacetabular osteotomy
HipNav
collection of
registration points during THR surgery, 6
surface points during THR surgery, 6
surgical navigation in total hip replacement, 3-8
Histiocytome, malignant fibrous, at knee, 231
HO, see Heterotrophic ossification
HSV, see Herpes simplex virus
Humphry type meniscal variant, 234
Hybrid control
rationale for, 250-251
testing load-displacement, lumbar spine biomechanics, 246-253
HYBRID POLARIS localizer, use in image-guided spinal surgery, 57

IDET, see Intradiscal electrothermic therapy
IGS, see Image-guided surgery
Image overlay system, in CMU augmented reality imaging technology, 85
Image-guided surgery, 64-68
Image-guided technology, intraoperative, periacetabular osteotomy, 14-19
Imaging, surgical, types, 82
Impaction allografting
clinical results, 144
femoral component revision in total hip replacement, 138-145
problems and complicatons, 143-144
Impaction grafting, acetabular reconstruction, 148
Impingement, ACL reconstruction, planning to avoid using CASPAR System, 53, 54
Implants
choice of for total hip replacement surgery, 94-101
hip replacement
cement adhesion, 98
acetabular component, 99
cemented sockets, 96
cemented stems, 96
cemented versus uncemented stems, 94
cementless stems, 98-99
choice of bearing surfaces, 97
ideal features, 95
methods of fixation, 97-98
negative influences in implant choices, 95-96
proximal porous-coated devices, 98
smooth stem, 98
tapered devices, 98-99
uncemented sockets, 96
uncemented stems, 96
oblong acetabular components, 154-155
titanium, total hip replacement surgery, 120-121
Infection, complicaton, impaction allografting, 143
Inflammatory agents, role in back pain, 259
Innervation, lumbar intervertebral disc, 289
Intercondylar notch, lateral adjustment of shades to borders to avoid wall impingement of graft in ACL reconstruction using CASPAR System, 53, 54
Intervertebral cages
cylindrical, complications, 321-323
placement complications, 320-321
Intervertebral disc
adenovirus-mediated gene transfer, 266-267
cartilaginous end plate, retrovirus-mediated gene transfer to, 267-268
degeneration, 254-262
gene therapy, 263-270
pathology, 271-273
desiccation and degeneration, MRI, 312
far lateral herniation, 296-298
surgical technique, 297-298
herniated, 272-273
innervation of, 273
locating herniation, 294
migrated, use of anatomical house concept to locate, 293

migration patterns, 292
pathologies, 273
see also Annular lamellae; Lumbar intervertebral disc
Intradiscal electrothermic therapy, see Electrothermic therapy, intradiscal
Introduction
lumbar spine surgery, 245
medical robotics and computer-assisted orthopaedic surgery, 1-2
meniscal surgery and treatment, 161
total hip replacement surgery, 93
IVD, see Intervertebral disc degeneration

Joint
articulation, determining reference points for in TKR arthroplasty, 25-39
kinematics, study of with robotic universal force-moment sensory, 87-91
replacement, using augmented reality imaging technology, 86

Knee
Anatomy
lateral side, 198
medial side, 197
determination of rotational center using rotational technique, 30
fixation for surgery using CASPAR System, 54
joint, stability of, role of meniscus, 166
meniscus
anatomy, 162-163
basic science, 162-168
biochemistry, 164
biomechanics, 165-166
classification of tears, 170-173
excursion, 164-165
healing of lesion, 166
joint lubrication and distribution of nutrition, 166
and knee joint stability, 166
magnetic resonance imaging, 169-182
MRI of tears, 170-173
neuroanatomy, 164
normal anatomy, 170
normal lateral, MRI, 171
postoperative MRI, 175-180
potential pitfalls in diagnosis of tears, 173-175
vascular anatomy, 163-164
replacement, total
computer-assisted arthroplasty, 25-39
mechanical alignment guides for surgery, 25
preoperative planning for computer-assisted surgery, 27
see also Anterior cruciate ligament; Meniscus
soft tissues masses about, 231

Laminectomy
intervertebral disc, 297
lumbar decompression technique, 299
microlumbar discectomy, 294
in posterior lumbar interbody fusion surgery, 314
Laminotomy
limited, and lumbar disc surgery, 286
microlumbar discectomy, 294
Laparoscopy, augmented reality imaging technology for, 83-85
Laser fiber, electrothermal therapy system, 275
Lateral meniscal variants, 234-244
MRI diagnostic criteria, 236
recommended treatment, 237-240
LDH, see Lumbar disc herniation, 272-273

Leg
length, determination in hybrid total hip replacement surgery, 116
pain, in lumbar disc herniation, 272
LFA, see Low frictional torque arthroplasty
Ligaments
attachment position for in computer-assisted arthroscopic ACL reconstruction, 43-44
use of robotic technology to study biomechanics and replacement, 87-91
Linvatec Stinger, meniscal repair tool,, 210
Liposarcoma, at knee, 231
Liposomes, nonviral vector for gene delivery, 265
LMV, see Lateral meniscal variant
Load-displacement, lumbar spine, study using robotic/UFS testing system with hybrid control, 246-253
Localizer, three-dimensional, use in computer-assisted spinal surgery, 56
Low back pain
anterior lumbar interbody fusion with metallic cages, 301-310
chronic discogenic, intradiscal electrothermal therapy, 271-281
MRI of lumbar spine in case of, 278
role of inflammatory agents, 259, 260
see Intervertebral disc, degeneration
Low frictional torque arthroplasty, Charnley method for total hip replacement, 115
Lumbar decompression, use of microscope in, 298-299
Lumbar disc
herniation, 272-273
MRI, 306
microendoscopic surgery, 282-287
Lumbar fusion surgery, gene therapy applications for, 325-331
Lumbar instability, treatment with posterior lumbar interbody fusion, 312
Lumbar interbody cages, implantation, 69
Lumbar interbody fusion
anterior, see Anterior lumbar interbody fusion
posterior, see Posterior lumbar interbody fusion
Lumbar intervertebral cages, limitations and complications, 320-324
Lumbar intervertebral disc
aging
alterations with, 256-258
and degeneration, 255-256
anatomy, 289-290
cell nutrition and viability, 258
cellular components, 255
degeneration
factors implicated, 258-260
relationship between factors implicated in, 260
grading scheme for, 257
morphologic signs of, 256-257
radiographic signs of, 256-257
risk factors for, 255-256
sequelae of, 257-258
localizing the nerve root, 289
matrix composition, 255
matrix degradation and modification, 259
mechanical loading effects, 259-260
see also Intervertebral disc
structure and function, 254-255
Lumbar spine
biomechanics, study methods, 246-253
disc degeneration, 254-262
flexion/extension, pathSEEK algorithm, 248
load-displacement response, hybrid control, 249-250
Lumbar vertebra, anatomy, 296

Lumbosacral spine, degenerative disc disease, radiography and MRI, 257

Magnetic resonance imaging
  diagnostic criteria for lateral meniscal variants, 236
  disc desiccation and degeneration, 312
  evaluating candidates for posterior lumbar interbody fusion, 312-313
  lumbar disc herniation, 306
  lumbar spine in case of disabling low back pain, 278
  lumbar vertebrae before and after laminoplasty, 298
  lumbosacral spine, degenerative disc disease, 257
  meniscus, 169-182
    cysts, 228
    tears, 170-173, 185
    after surgery, 175-180
  snapping knee syndrome, discoid lateral meniscus, 242-243
Mallory-Head Calcar Replacement stem, 134
Massachusetts Institute of Technology, and Brigham and Women's Hospital, development of augmented reality imaging technology, 83
MAT, see Meniscal allograft transplant
Material fiducials, for CAS, 57
MCL, see Medial collateral ligament
MED, see Microendoscopic discectomy
Medial collateral ligament, biomechanics of healing, robotic UFS system, 89-90
Meniscectomy, partial
  surgical techniques for, 239
  technique, 189-191
Meniscocapsular separation, MRI, 173
Meniscofemoral ligament, MRI, 175
Meniscus
  allograft technique, 220-226
  allograft transplant, 220-226
    preparation, 220-222
    single bone plug, 222
  anatomy, posterior views, 235
  cysts, 227-233
    MRI, 179, 180
  diagnosis of injury, 184-185
  discoid, MRI, 178, 180
  flounce, postoperative MRI, 176
  lateral, 163
    tears, operative technique, 213
    transplantation, 222-225
    variants, 234-244
  lesions, algorithm for treating, 184
  medial , 162-163
    tears, operative technique, 213
  pediatric, MRI, 179-180
  removal for meniscal allograft transplant, 220
  repair
    all-inside, 203-207
    arthroscopic with fibrin glue, 212-219
    conventional techniques, 194-208
    indication for, 194-195
    inside-out, 198-202
    instruments used in, 202
    new tools for, 209-211
    open technique, 195-196
    outside-in, 202-203
    postoperative rehabilitation, 207
    suture hooks used, 206
  see Knee, meniscus; Meniscectomy
  structure and function, 183-184
  tears
    classification of, 184-185
    MRI, 185
    surgical indications, 185-189
    tears, resection versus repairs, 186-189
  transplant, MRI, 179
Metal cage
  anterior lumbar interbody fusion, 301-310
  lumbar intervertebral, 320-324
  placement for interbody fusion in POLAr technique, 317
  in posterior lumbar interbody fusion, 311-319
  see also Bagby and Kulich device; Intervertebral cages; Metal cage; Titanium
Microendoscopic discectomy, 282-287
  operating room setup, 283
  patient setup, 283
  technique, 284-286
Microendoscopic surgery, lumbar disc, 282-287
Microlumbar discectomy
  laminotomy and laminectomy in, 294
  locating disc herniation, 294
  method for entering spinal canal, 293-296
  muscle elevation, 292-293
  patient positioning, 291-292
  surgical dissection, 292
  surgical technique, 290-296
  treatment, lumbar radiculopathy, 288-300
Microscope, use in microlumbar discectomy, 288-289
Migration, cylindrical intervertebral cages, 321
Miniscectomy, 183-193
Misplacement, cylindrical intervertebral cages, 321-322
Mitek meniscal repair system, 211
Morsellized graft, acetabular reconstruction, 147
MRI, see Magnetic resonance imaging
Myelogram, lumbar, stand-along posterior lumbar interbody fusion, 315

Navigation
  in image-guided spinal surgery, 66-67
  see also HipNav
  software, in CAS, 57
Needle biopsy, augmented reality imaging technology for, 83-85
Nerve tissue, in intervertebral disc, 273
Neuroanatomy, meniscus of knee, 164
Neurosurgery, augmented reality imaging technology for, 83, 84, 85
Nitric acid, role in low back pain, 259, 260
Notice, Thirty-first Annual Meeting of the Eastern Orthopaedic Association, 160
Nucleus pulpous, herniated, complication of cylindrical intervertebral cages, 322

Oblique menisco-meniscal ligament, postoperative MRI, 176
Oblong cups, acetabular reconstruction, 148
OPTOTRAK 3020 optoelectronic localizer
  CAS orthopedic system, 70
  use in
    computer-assisted arthroscopic ACL reconstruction, 41-45
    PAO, 15-18
Oratec, electrothermal therapy system, 275
Orthodoc workstation, use in THR surgery, 9-13
Orthopaedic surgery
  augmented reality imaging technology, 82-86
  current needs, 1
  minimally invasive techniques, 20-21
  see also specific procedures
Osteoarthritis, knee, computer-assisted TKR surgery, 25-39

Osteolysis
acceleration by patch coating of hip replacement implants, 98
acetabular, surgical repair, 146-152
pelvic, radiography of failed porous-coated cup, 150
Osteonecrosis, hip, hemiresurfacing arthroplasty, 123-132
Osteotomy, periacetabular, computer-assisted, 14-19
Owl's eye view, for pedicle screw insertion, 78-79

Pain
discogenic, treatment with posterior lumbar interbody fusion, 312
herniated disc, 282
leg and back, lumbar disc herniation, 272
and patient selection for hybrid total hip replacement surgery, 115-116
radicular, complication of cylindrical intervertebral cages, 322
see also Low back pain
PAO, see Periacetabular osteotomy
Pars interarticularis
identification, 289-290
lateral and true, 291
Patellar tendon, bovine, electrothermal treatment, 274
PathSEEK algorithm, hybrid control, delineation of load-displacement characteristics of lumbar FSU's in flexion/extension, 248
PCL, see Posterior cruciate ligament
Pedicle, vertebral, finding in microlumbar discectomy, 297
Pedicle screw
insertion using virtual fluoroscopy system, 78-79
inserted in spine using CAS techniques, 59-61
Pelvis
discontinuity, 151
osteotomy, computer-assisted, 14-19
positioning as key to acetabular component positioning in hybrid total hip replacement surgery, 117
ring, disruptions, percutaneous fixation with computer-assisted surgery, 20-24
Percutaneous techniques, fixation of acetabular fractures, 21-23
Periacetabular osteotomy
computer-assisted, 14-19
image guidance equipment for, 15
Pin
placement, hemiresurfacing arthroplasty, 127
procedure, in THR surgery using Robodoc, 10
Planner
three-dimensional preoperative, HipNav, 3-8
for THR surgery, using Robodoc system, 10-11
Plasmid, nonviral vector for gene delivery, 265
PLIF, see Posterior lumbar interbody fusion
POLAr technique, posterior lumbar interbody fusion, 315-316
Popliteus tendon, postoperative MRI, 176
Position tracking, augmented reality imaging technology, 83
Posterior condyles, digitization for computer-assisted arthroscopic ACL reconstruction, 43
Posterior cruciate ligament
biomechanics, robotic UFS system, 88-89
reconstruction, biomechanics, robotic UFS system, 88-89
Posterior lumbar interbody fusion
complications, 318
evaluation of clinical outcome after, 318
indications for surgery, 311-312
metal cages, 311-319
surgical technqiue, 313-316
using virtual fluoroscopy system, 79
Prostaglandin E2, role in low back pain, 259, 260
Proteoglycans, in lumbar intervertebral disc, 255
Pseudarthrosis, complication of cylindrical intervertebral cages, 322-323

Radiculopathy
lumbar, treatment with microlumbar discectomy and decompression, 288-300
role of inflammatory agents, 259
Radiofrequency needed, electrothermal therapy system, 275
Radiography
acetabulum with long acetabular defect, 158
after hemiresurfacing arthroplasty, 131
AP pelvis, 103
classification of acetabular defects, 149
evaluation of hip osteonecrosis, 124
failed porous-coated cup with extensive pelvic osteolysis, 150
femoral bone defects, 134-135
femoral component revision, impaction allografting in total hip replacement, 140-143
hip osteonecrosis lesions, 130
loose cemented total hip arthroplasty, 104
loss total hip arthroplasty, 157
lumbar fusion with lateral BAK cage, 309
lumbar spine with SpineCATH in position, 279
lumbosacral spine, degenerative disc disease, 257
method of Ranawat, acetabular reconstruction, 155
pelvic discontinuity, 151
placement of distraction plugs, spinal surgery, 302
preoperative templating prior to total hip replacement surgery, 102-105
retropulsion of intervertebral cage, 323
use in computer-assisted arthroscopic ACL reconstruction, 41-45
Range of motion planner, HipNav, 5
Ray Threaded Fusion Cage, 320
Ray titanium device, metallic cage for anterior lumbar interbody fusion, 301
Reference frame, use in image-guided spinal surgery, 59
Reference system, dynamic reference arc for image-guided spinal surgery, 64, 66
Registration
accuracy of in image-guided spinal surgery, 66
methods for in CAS, 57
see also Dynamic reference arc
surface-based, in CAS, 57
Retrovirus
gene transfer to cartilaginous end plate of intervertebral disc, 267-268
vector for gene delivery, 265
ROBODOC system, 1
Robodoc System, use in THR surgery, 9-13
Robot
preparation for THR surgery using Robodoc system, 11
Robodoc for THR surgery, 11-13
Robot-assisted surgery
ACL reconstruction, 50-55
THR, indications, 9
total hip replacement, 9-13
Robotic technology, study of biomechanics and replacement of ligaments, 87-91
Robotic/UFS testing system
implementation of displacement control method, 251-252
study of lumbar spine biomechanics, 246-253
Robotics, study of lumbar spine biomechanics, 246-253
ROM, see Range of motion
Rotation, femoral component, establishing during computer-assisted TKR surgery, 37
Rotational technique, determination of
center of femoral head, 28
rotational center of ankle and knee, 30
Rotator cuff, biomechanics of normal and injured, robotic UFS system, 89

Sacroiliac joint, percutaneous fixation of disruption using computer-assisted surgery, 23
Shoulder, biomechanics or normal and injured, robotic UFS system, 89
Simulator, HipNav, for THR surgery, 3
Smith Petersen approach, total hip replacement surgery, 106-107
Snapping knee syndrome, 236
Software, control, augmented reality imaging technology, 83
Spinal cage
  computer-guided insertion, 75
  delivery, computer-assisted surgery for, 69-76
  intraoperative distraction control using CAS, 74
  planning position using CAS, 73-74
  see also Bagby and Kuslich device
Spinal canal, method for entering in microlumbar discectomy, 293-296
Spine
  cervical, CT images and three-dimensional reconstruction, 65
  comparison of computer-assisted versus conventional surgery, 60
  fusion
    application of spinal interbody cages, 69-76
    evaluation of gene therapy for, 328-330
    see also Lumbar fusion surgery
  image-guided surgery, 56-63, 64-68
  pedicle screw insertion using virtual fluoroscopy system, 78-79
  posterior lumbar interbody fusion, using virtual fluoroscopy system, 79
  rate, gene therapy-induced fusion in, 329
  three-floor anatomical house concept, 290, 291, 293
SpineCATH, intradiscal electrothermal therapy, 271-281
S-ROM Arthropor II oblong cups, acetabular reconstruction, 155
Stealth Station Image-Guided Surgery system, use in
  image-guided spinal surgery, 57-62
  spinal surgery, 64-68
  virtual fluoroscopy, 78
Stenosis, lateral recess, complication of cylindrical intervertebral cages, 322
Structural bulk allografts, acetabular reconstruction, 147
Subsidence, complication, impaction allografting, 143-144
Surgical approaches, total hip replacement surgery, 106-114
  comparison of methods, 112-113
Surgical Dynamics Stapler, meniscal repair tool, 211
Surgical instruments, visualization in CAS, 57
Surgical navigation, HipNav in total hip replacement, 3-8
Surgical technique
  acetabular reconstruction, 155-156
  acetabular revision, 149-151
  anterior lumbar interbody fusion, 303-305
  double-tapered cementless stems, total hip replacement, 120-121
  excision of meniscal cysts, 232
  far lateral herniation of intervertebral disc, 297-298
  hemiresurfacing arthroplasty, 124-129
  hybrid total hip replacement surgery, 117-119
  impaction allografting for femoral component revision in total hip replacement, 139-143
  lumbar decompression, 298-299
  microlumbar discectomy, 290-296
  partial meniscectomy, 239
  posterior lumbar interbody fusion, 313-316
Synovial sarcoma, at knee, 231
Synovitis, pigmented villonodular, at knee, 231

Target cell, and gene therapy, 328
Temperature, mapping studies in electrothermal therapy, 274-276
Templating
  hybrid total hip replacement surgery, 116
  preoperative, for total hip replacement surgery, 102-105
THA, see Total hip arthroplasty
THR, see Total hip replacement
Threaded cups, in acetabular reconstruction, 145
Three-floor anatomical house, in spinal surgery, 290, 291, 293
Tibia
  digitization for computer-assisted arthroscopic ACL reconstruction, 42-43
  planning tunnel for ACL reconstruction using CASPAR System, 52-53
  preparation for TKR computer-assisted surgery, 29
  trial reduction, computer-assisted TKR surgery, 38
  trial reduction, mechanical versus computer-assisted techniques, 32
Tibial plateau, patterns of pressure distribution, 165
Tibial point, positioning along Blumensaat line to avoid notch impingement, 54
Titanium
  lumbar intervertebral cages, 320-324
  metallic cage for anterior lumbar interbody fusion, 301
  use in femoral revision hip arthroplasty, 136
  wedge, double-tapered, for total hip replacement, 120-122
TKR, see Total knee replacement
Tokyo Women's Medical College, development of augmented reality imaging technology, 85
Total hip arthroplasty, see Hip replacement, total
Total hip replacement, see Hip replacement, total
Total knee replacement, see Knee replacement, total
Transpedicle screw insertion
  complications, 61-62
  using CAS techniques, 59-61
Transplant, meniscal allograft, 220-226
Tumor removal, using augmented reality imaging technology, 86

UFS, see Universal force-moment sensor
Universal force-moment sensor, robotic, study of joint kinematics with, 87-91
University of North Carolina, development of augmented reality imaging technology, 83, 85
University of Pittsburgh Medical Center Shadyside Hospital, development of augmented reality imaging technology, 85

Vectors, nonvirual, for gene delivery, 265
Vertebra
  endoscopic view for CAS, 72
  lumbar, anatomy, 296
  see also Intervertebral disc; Lumbar intervertebral disc
Viral vectors, gene delivery systems for gene therapy, 264-265
Virtual fluorscopy, see Fluoroscopy, virtual
Virtual reality, see Augmented reality imaging technology

Watson-Jones approach, total hip replacement surgery, 107-109
Wrisberg type meniscal variant, 234